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TITLE: Wells-Dawson type heteropolyacids, their preparation and use as oxidation catalysts

BSPL:

where G is Cu, Fe, Co, Mn, Ni, La, Li, Na, K or Rb, or an oxy ion of Ti, V, Cr, Mo, U, As, Bi, Sb, Nb, or ammonium, tetraalkylammonium, pyridinium, quinolinium, protonated aromatic amines or protonated aliphatic amines, or combinations thereof, or is absent; X is a Group IIB, IVB, VB, VIB or **transition element, such as phosphorus, silicon, gallium**, aluminum, arsenic, germanium, boron, cobalt, cerium, praseodymium, uranium and thorium; M is molybdenum or tungsten, or combinations thereof, M' is vanadium; M'' is independently zinc or a transition metal different from M and M', such as titanium, zirconium, hafnium, niobium, tantalum, chromium, manganese, rhenium, iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, platinum, copper or combination thereof, z' is the charge on said cation G; m' is 12 to 18, x' is 0 to 6, n' is 0 to 3, where $m' + x' + n' = 18$; y' is 48 to 62; and e' is the charge of the anion of the polyoxometallate. The support component comprises an insoluble polyoxometallate salt having the formula:

DEPL:

where cation G is Cu.sup.++, Fe.sup.+++, Co, Mn, Ni, La, Li, Na, K or Rb, or an oxy ion of Ti, V, Cr, Mo, U, As, Bi, Sb, Nb, or ammonium, tetraalkylammonium, pyridinium, quinolinium, protonated aromatic amines or protonated aliphatic amines, or combinations thereof, or is absent; X is a Group IIB, IVB, VB, VIB or **transition element, such as phosphorus, silicon, gallium**, aluminum, arsenic, germanium, boron, cobalt, cerium, praseodymium, uranium and thorium; M is molybdenum or tungsten, or combinations thereof, M' is vanadium; M'' is

independently zinc or a transition metal different from M and M', such as titanium, zirconium, hafnium, niobium, tantalum, chromium, manganese, rhenium, iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, platinum, copper or combination thereof; z' is the charge on said cation G; m' is 12 to 18, x' is 0 to 6, n' is 0 to 3, where $m'+x'+n'=18$; y' is 48 to 62; b is the number of cations G; e' is the charge of the anion of the polyoxometallate.

DEPL:

where, in the HPA $H_{(e'-bz')} G_b (X_2 M_{m'-x'} M'_{x'} M''_{n'} O_{y'})_{sup.-e'}$, G, the cation, is $Cu_{sup.++}$, $Fe_{sup.+++}$, lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cobalt (Co), manganese (Mn),

nickel (Ni), or lanthanum (La), or an oxy ion of titanium (Ti), vanadium (V), chromium (Cr), uranium (U), arsenic (As), bismuth (Bi), tin (Sn), niobium (Nb),

or ammonium, tetraalkylammonium, pyridinium, quinolinium, protonated aromatic

amines or protonated aliphatic amines, or combinations thereof, or is absent;

X, the central or hetero atom, is a Group IIB, IVB, VB, VIB or **transition element, such as phosphorus, silicon, gallium**, aluminum, arsenic, germanium,

boron, cobalt, cerium, praseodymium, uranium and thorium; M, the first framework metal is molybdenum or tungsten or combinations thereof; M' is vanadium substituted for first framework metal M; M'', the second framework metal, is different from M and is independently zinc or a transition metal, such as titanium, zirconium, hafnium, niobium, tantalum, chromium, manganese,

rhenium, iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium,

platinum, copper or combination thereof, m' is 12 to 18, x' is 0 to 6, n' is 0 to 3 where $m'+x'+n'=18$; y' is 48 to 62; e' is the charge of the anion of the heteropolyacid; and z' is the charge on the cation G; and where, in the POM $C_a H_{(e-bz)} (X_k M_m M'_{x'} M''_{n'} O_y)_{sup.-e}$, C is

selected from the group consisting of potassium, rubidium, cesium, magnesium,

calcium, strontium, barium, lanthanum, ammonium, tetraalkylammonium, pyridinium, quinolinium, protonated aromatic amines and protonated aliphatic

amines, or combinations thereof; X is a Group IIIB, IVB, VB, VIB or transition metal; M is molybdenum or tungsten or combinations thereof; M' is vanadium; M''

is independently zinc or a transition metal different from M and M', or combination thereof, z is the charge on said cation C; k is 1 to 5, m is 5 to 18, x is 0 to 6, n is 0 to 3; y is 18 to 62; and when "az" equals "e", there are no protons present in the polyoxometallate support.